The capacitance between the electrode 28 and the rest of the vehicle may be monitored as the bag is inflated, and the deployment of the bag may be controlled in response to this monitoring.

In the embodiments described above, the capacitance measuring device may comprise a measuring bridge, one part of which forms the capacitor defined effectively between the electrode or electrodes mounted in or in the region of the dashboard, or on the steering wheel and the main body of the motor vehicle, and capacitance may be measured by discharging the capacitance through a known resistance, measuring the time taken to discharge the capacitor by a known amount. Alternatively, the capacitor defined between the said electrode or electrodes and the monocoque shell may be used as part of an oscillating circuit, the frequency of the oscillating circuit being dependent upon the value of the capacitance of the capacitor. Other capacitance measuring devices may be utilised.

It is to be noted that in the described embodiments of the invention, it is preferred that the electrode or electrodes which are mounted on the dashboard or on the steering wheel, or on the exterior of the air-bag, are initially positioned in such a way that, with regard to the capacitance created between that electrode and the rest of the motor vehicle, the top surface of the dashboard or the top surface of the steering wheel is super-imposed on a notional equi-potential surface of the capacitor.

The potential between the two opposed "plates" of a capacitor is such that, when the capacitor is charged, adjacent one plate there is a high potential and adjacent the other plate, there is a low potential. Between the two plates are a plurality of notional equi-potential surfaces,

every point on each equi-potential surface having exactly the same potential.

If the surface of the dashboard a steering wheel is substantially coincident with one of the notional equi-potential surfaces of the capacitor defined by the electrode and the rest of the body of the motor vehicle, then should any dampness form upon the outer surface of the dashboard or steering wheel due, for example, to condensation within the motor vehicle, then the described apparatus will still function in an appropriate manner, since the conductive effect provided by the moisture on the surface will not provide a conductive path between notional equi-potential planes of different potentials.

Whilst the invention has been described with reference to specific embodiment, it is to be appreciated that changes may be effected without departing from the scope of the invention as defined by the following Claims.

CLAIMS:

1. An air-bag arrangement in a motor vehicle, the air-bag arrangement comprising an air-bag and an associated gas generator and means adapted to initiate inflation of the air-bag in the event that an accident should arise, the air-bag being located in such a position that, when inflated, it is situated in front of a front seat occupant of a motor vehicle, the vehicle being provided with proximity sensing means adapted to sense when the occupant within the vehicle is located at least partly adjacent the position that will be occupied by the air-bag when it is inflated in front of the front dashboard or steering wheel of the vehicle, the proximity sensing means comprising at least one conductive electrode, said electrode being located on or adjacent the front dashboard or steering wheel of the motor vehicle, said electrode forming part of a capacitor, capacitance measuring means being provided to generate a signal representative of or related to the capacitance of said capacitor and control means being provided to inhibit or modify deployment of the air-bag when said signal exceeds predetermined parameters.

2. An arrangement according to Claim 1 wherein the control means are adapted to inhibit or modify deployment of the air-bag when the measured capacitance of the capacitor exceeds a predetermined threshold.

3. An arrangement according to Claim 1 wherein the control means are adapted to inhibit or modify deployment of the air-bag when the rate of change of capacitance of the capacitor exceeds a predetermined threshold.

4. An arrangement according to any one of the preceding Claims wherein said capacitance is defined between one or more said electrodes located on or adjacent the dashboard and the body of the motor vehicle.

5. An arrangement according to any one of Claims 1 to 3 wherein the capacitance is defined between two said electrodes located on or adjacent the dashboard of the vehicle.

6. An arrangement according to any of the preceding Claims wherein the air-bag is provided with an housing, the housing being provided with a door through which the air-bag may emerge when inflated, the door forming part of the dashboard of the vehicle, said electrode being mounted on, in or adjacent said door.

7. An arrangement according to Claim 6 wherein said electrode is moulded integrally with the door.

8. An arrangement according to Claim 7 wherein the door is provided with a second electrode which is connected to the first electrode by means of a buffer amplifier having a high impedance, so as to provide a shielding effect for the first electrode from all items mounted on the side of the second electrode remote from the first electrode.

9. An arrangement according to Claim 8 wherein the or each electrode is a metal foil.

10. An arrangement according to any one of Claims 1 to 6 wherein two electrodes are provided in the dashboard or steering wheel, the capacitance measuring means being adapted to measure the capacitance between said two electrodes.

11. An arrangement according to Claim 6 or 10 wherein the electrode or electrodes are provided in the dashboard or steering wheel, adjacent the periphery of the door.

12. An arrangement according to Claim 11 as dependent upon Claim 10 wherein the two electrodes are provided on opposed sides of the door.

13. An arrangement according to Claim 10 wherein the electrode comprises a frame surrounding the periphery of the door.

14. An arrangement according to any one of Claims 1 to 3 wherein the electrode is provided on the outer surface of the air-bag at such a position that, when the air-bag is in the folded state, the electrode lies immediately adjacent the dashboard or steering wheel.

15. An arrangement according to any one of the preceding Claims wherein the capacitance measuring means discharge the charge on the capacitor through a known resistance and determine the time taken for the charge to fall by a predetermined amount.

16. An arrangement according to any one of Claims 1 to 14 wherein the capacitance measuring means comprise an oscillating circuit, the capacitance forming part of the oscillating circuit, means being provided to determine the frequency of oscillation of the oscillating circuit.

17. An arrangement according to any one of the preceding Claims wherein means are provided to modify the deployment of the air-bag comprising means adapted to establish an opening communicating with the interior of the air-bag.

18. An arrangement according to Claim 17 wherein the means to establish an opening communicating with the interior of the air-bag comprise a piston and cylinder arrangement, a pyrotechnic charge associated with the piston and cylinder arrangement adapted, when activated, to cause the piston to move within the cylinder, means connecting the piston to part of the combination of the air-bag and the housing, the arrangement being such that when the pyrotechnic charge is activated, the piston moves, thus separating said part from the rest of the combination to cause the opening to be established.

19. An arrangement according to any one of the preceding Claims wherein the or each electrode is located so that the front surface of the dashboard lies substantially on a notional equi-potential surface of the resulting capacitor.

20. An arrangement according to any one of the preceding Claims wherein at least one sensor is provided in said front seat, responsive to an occupant of the seat, the sensor providing a signal to said control means.

21. An arrangement according to Claim 20 wherein the sensor is in the squab of the seat.

22. An arrangement according to Claim 20 or 21 wherein the sensor is in the back of the seat.

23. An arrangement according to any one of Claims 20 to 22 wherein the seat is provided with at least one capacitative sensor.

24. An arrangement according to any one of the preceding Claims wherein, in use deployment of the air-bag

is inhibited when said occupant is closer than a predetermined distance from said dashboard.

25. An arrangement according to Claim 24 wherein said distance is in the range of 150-200 mm.

26. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings.

27. An air-bag arrangement substantially as herein described with reference to and as shown in Figure 4 of the accompanying drawings.

28. An air-bag arrangement substantially as herein described with reference to and as shown in Figure 5 of the accompanying drawings.

29. An air-bag arrangement substantially as herein described with reference to and as shown in Figure 6 of the accompanying drawings.

39. Any novel feature or combination of features disclosed herein.

The Patent Office

Application No: GB 9704343.4 **Examiner:** Karl Whitfield
Claims searched: 1 to 25 **Date of search:** 20 March 1998

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7B (BSBCR, BSBNC), G1N (NDPQ, NDPX)

Int Cl (Ed.6): B60R 21/00, 21/02, 21/16

Other: Online database: Derwent World Patents Index accessed via Questel

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 97/01458 A1	(ALLIEDSIGNAL) whole document	1 at least
A, E	WO 97/35738 A1	(ADVANCED SAFETY) whole document	
A, E	WO 97/29391 A1	(SCANDMEC) whole document	
A	WO 96/09193 A1	(KITHIL) see especially figure 2	
A	WO 95/21752 A1	(VOLVO) see especially figures 1 & 3	
A	WO 95/00368 A1	(VOS VERKEHRS-OPTIMIERUNGS-SYSTEME) see especially figure 1	
A	Vehicle Engineering & Design September 1996, S Snook, "Smart Moves", pages 19 to 20, especially page 20 paragraph headed "Head Sense"		

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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